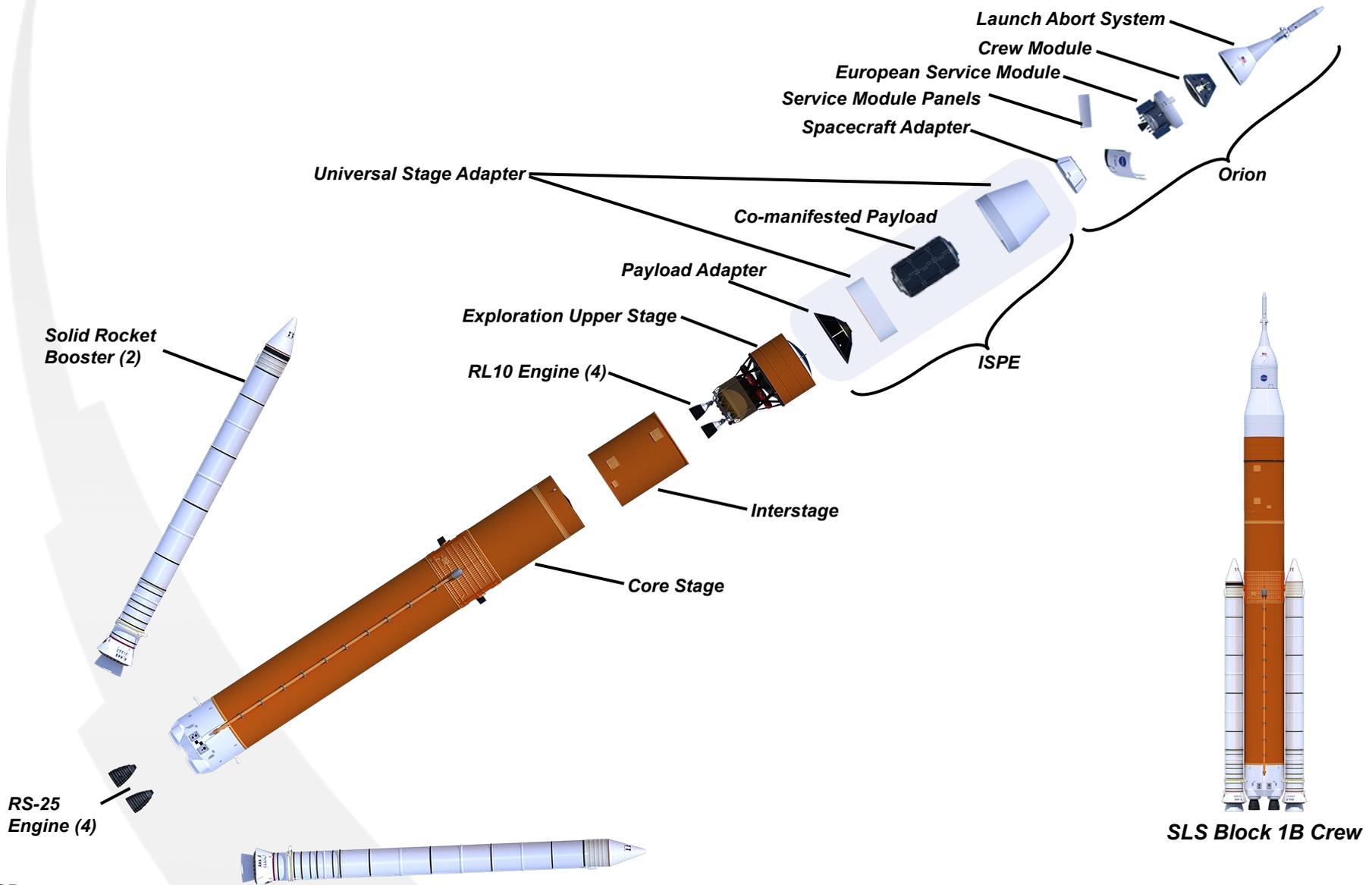


# SLS Gateway I-Hab Integration Overview

Presented by  
SLS SPIE XP50  
JANUARY 2021 IHAB TIM



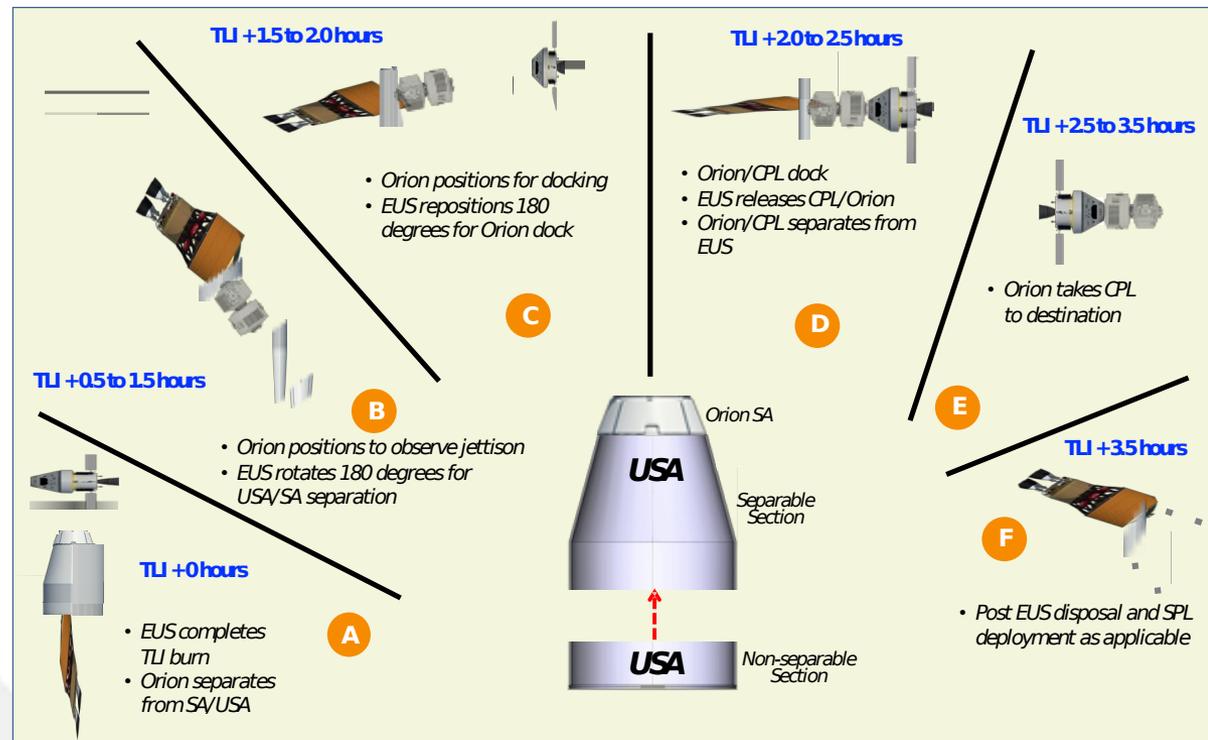
# Block 1B Crew Expanded View



# GENERIC CON-OPS TO DEPLOY

- **SLS payload Integration overview for Gateway Logistics as Co-manifested Payload (CPL)**
  - SLS CPL performance available in mid to late 2020's
  - SLS Block 1B payload accommodations
  - SLS Payload Integration Process
- **Preliminary SLS-Gateway Next Steps**

## SLS-CPL Concept of Operations



# SLS Gateway Mission Phase Configurations

**SLS Phase**

**Off-line Processing**

**VAB to Launch**

**Ascent to TLI**

**Post Orion Separation**

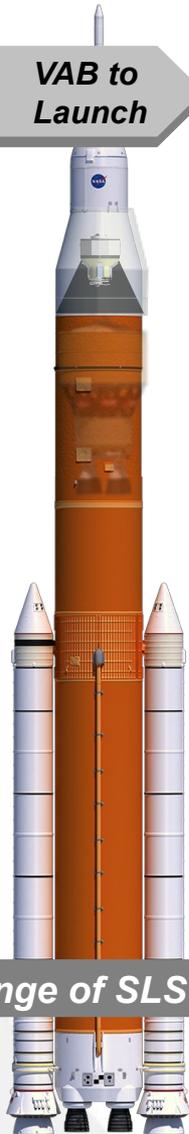
**Post USA Jettison**

**Orion to PL Docking**

**Orion/PL Separation**



- Elements**
- ISPE
    - USA (sep)
    - Gateway
    - USA (nsep)
    - PLA



- Orion
  - SA
- ISPE
  - USA
  - Gateway
  - PLA
- EUS



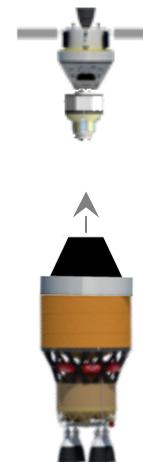
- Orion SA
- ISPE
  - USA
  - Gateway
  - PLA
- EUS



- ISPE
  - Gateway
  - USA (nsep)
  - PLA
- EUS



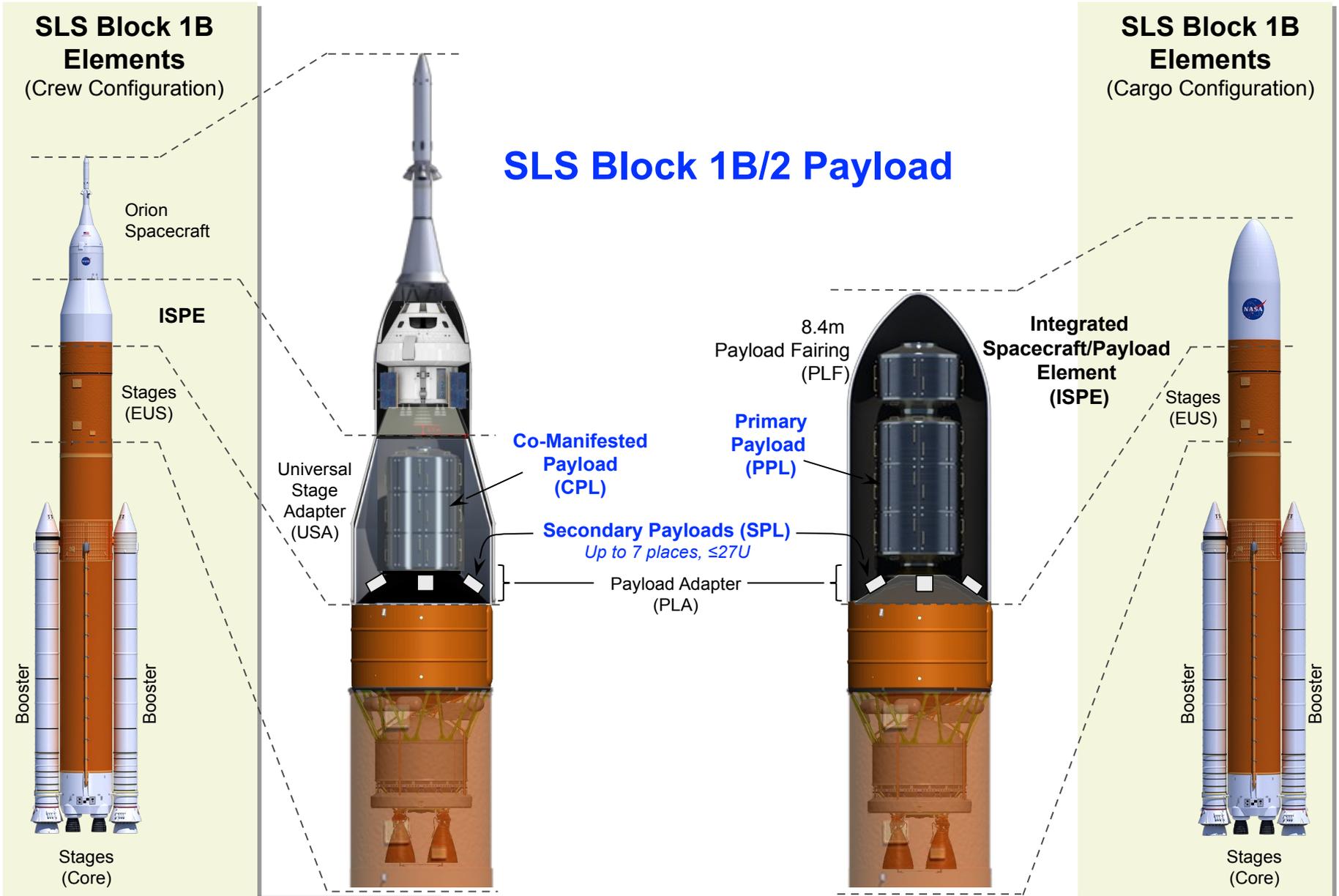
- Orion
- ISPE
  - Gateway
  - USA (nsep)
  - PLA
- EUS



- Orion
  - Gateway
- ISPE
  - USA (nsep)
  - PLA
- EUS

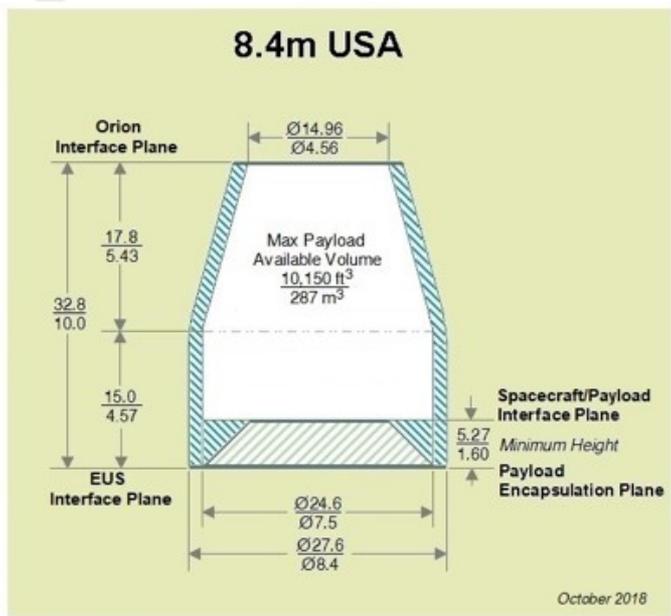
*Range of SLS SPIE Payload Integration Documentation and Support*

# SLS Block 1B Crew/Cargo Integrated Spacecraft/Payload Element (ISPE)



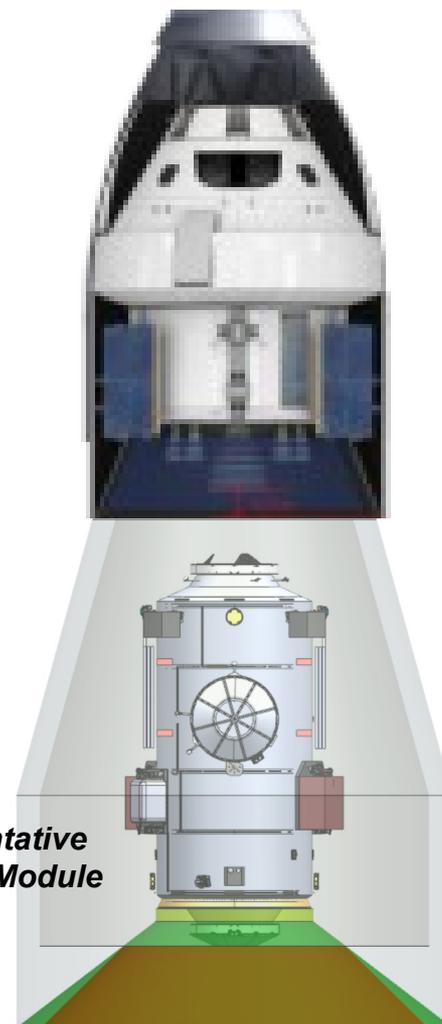
# SLS B1B Accommodations: Logistics Concept

## USA Baseline



- Available Payload Dynamic Envelope
  - USA Envelope (w/ acoustic attenuation)
  - Minimum Payload Adapter (PLA) Envelope
- All dimensions in Feet  
m
- Height of the spacecraft separation/interface plane depends on spacecraft/PLA attach diameter and PLA cone angle
- Spacecraft appendages projecting below spacecraft interface plane may be permitted; coordinate with SLS/SPIE

- Factors that directly impact PLA mass
  - PLA frequency requirement: further reduction below 10 Hz could result in lower PLA mass
  - CPL payload Center of Gravity offset (CG):
  - Interface diameter: increasing interface diameter higher than 3100 mm will result in lower PLA mass

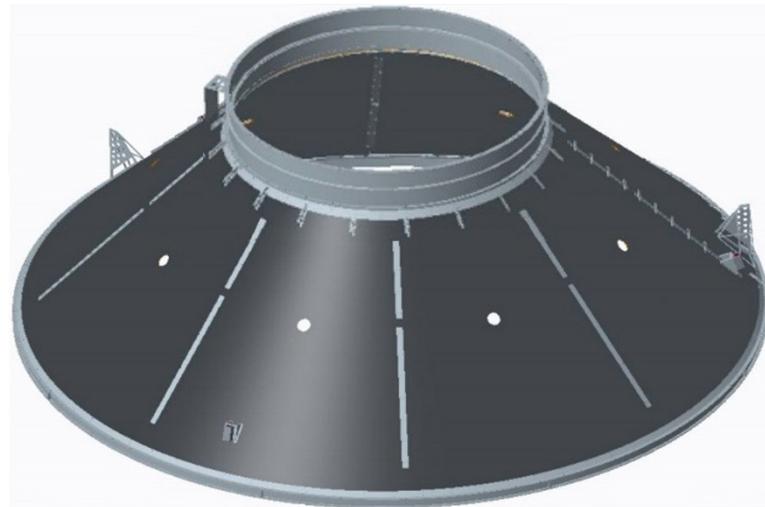


# 3100-1020 Co-Manifested Payload Adapter (PLA)

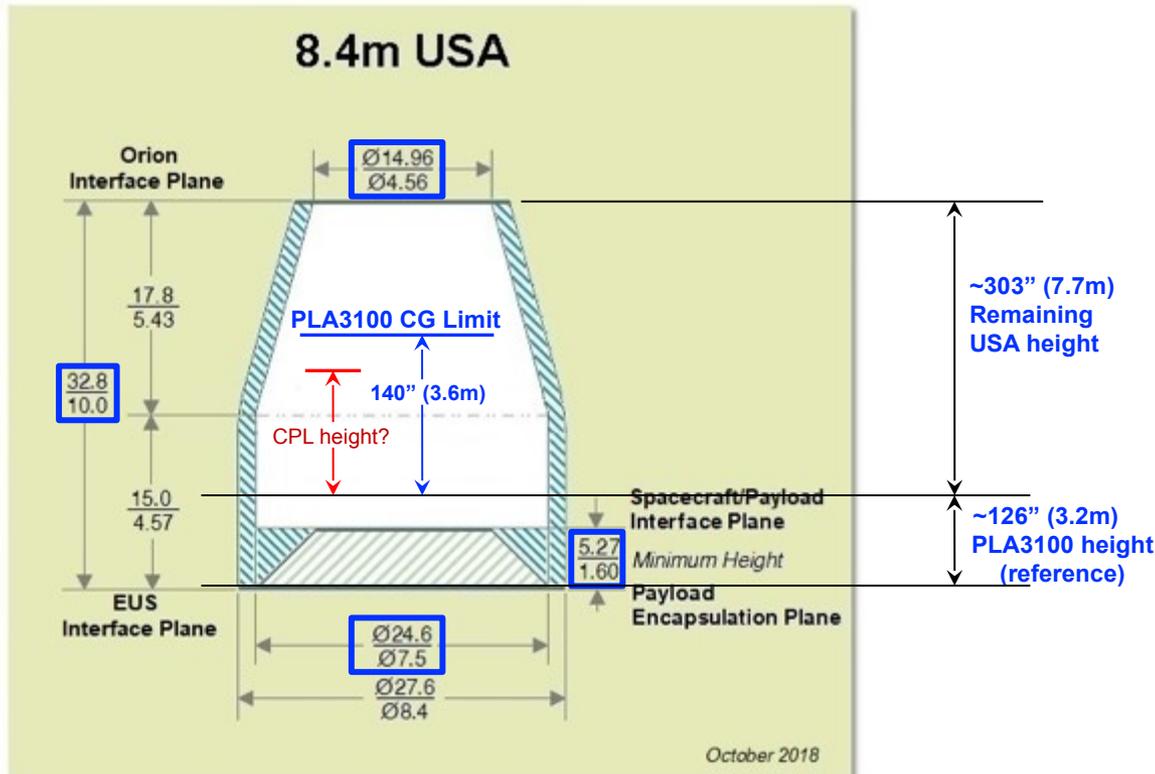
## 3100-1020 PLA characteristics

- 3100 mm payload interface
- 10.2 metric ton payload capability
- Eight segment conical composite laminate construction with aluminum upper and lower rings
- 3100 mm separation system will be incorporated, with trade study in work evaluating two approaches:
  - Utilize commercial 3100 mm clamp band separation system
  - Apply commercial Non-Explosive Actuators to new separation ring structures

3100-1020 PLA



# SLS to Gateway Logistics Needed Design Variables



## GENERIC DATA REQUIRED FROM CPL

### Gateway CPL Attributes needed (Lv II)

- Mass Properties
- Payload Envelope
- Structural FEM
- Axial and Lateral CG Offset

### Gateway CPL Separation System (Lv III)

- Min and max CPL mass
- CPL interface diameter
- Max CPL axial CG from the sep plane
- Max CPL lateral CG from the centerline
- Minimum lateral (Iyy, Izz) inertia
- Max dimensions (height and radius) E CPL below the sep plane and nested within the PLA
- CPL dynamic constraints for the PSS
  - Min and max axial delta V
  - Min and max axial acceleration
  - Max tip-off angular velocity

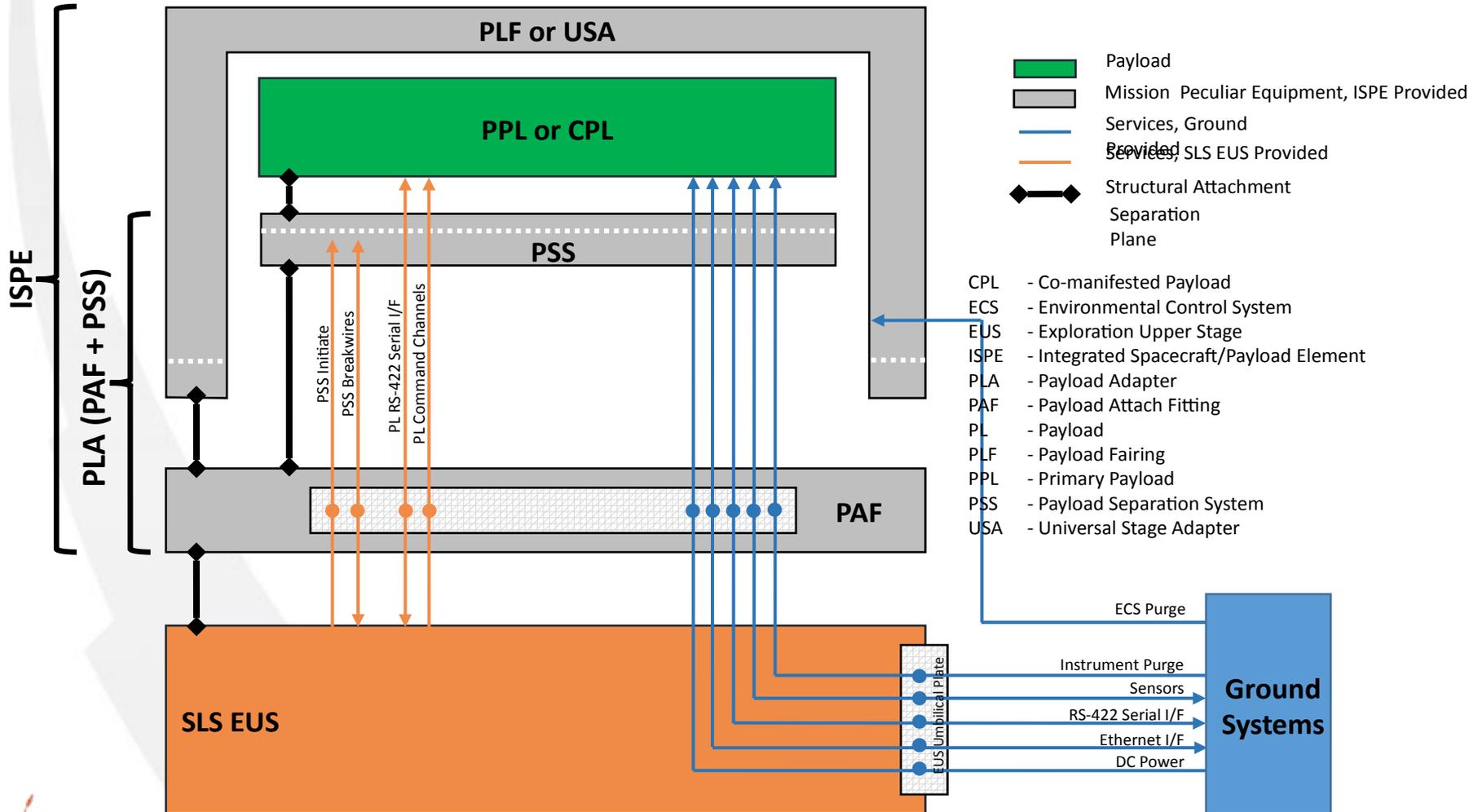
### EUS Needs

- Data needs beyond standard services?

Capabilities

Needed CPL Input

# SLS Block 1B ISPE PPL, CPL and SPL Interfaces



**QUESTIONS**

# SLS PAYLOAD INTEGRATION PROCESS

Presented by  
SLS SPIE XP50  
JANUARY 2021 IHAB TIM



National Aeronautics and  
Space Administration



[www.nasa.gov](http://www.nasa.gov)



# SLS Payload Physical Integration

## Phases of Payload Processing

SLS Manifested Payloads



### Standalone Processing

- Gateway Payload Processing (ERT)**
- Transportation to processing facility
  - Customer GSE set up
  - Final assembly & integration
  - Post-delivery inspection & test
  - Multi-Element integrated test window
  - Transportation to encapsulation facility



- LSSRD data feeds PRD
- Payload Special agreements
- Center transportation services
- Facility cleanliness requirements
- Non-Standard services
- Security measures
- Contingency plans

ERT NASA Operations Manager (NOM)



### Offline Processing

**Integration of Payload to NASA/SLS hardware**

- Payload Fueling\*
- Payload mate to PLA
- SPL installation
- Encapsulation (ISPE)
- System performance and interface testing
- Transportation to VAB



- LSSRD data feeds PRD
- NSS purge requirements
- Purge requirements
- Transportation & Handling requirements
- OMRS provides work instructions via WADS
- Contingency plans

\* Spacecraft customer dependent

EGS and LSP NOM

### Integrated Processing



**Integration (Stacking) of ISPE to SLS LV**

- Install GSC in PAS (Payload User Room)
- Set up of required GSE in Launch Control Center
- Set up of clean rooms for access
- Integrated verification testing
- Rollout activities
- Launch Operations



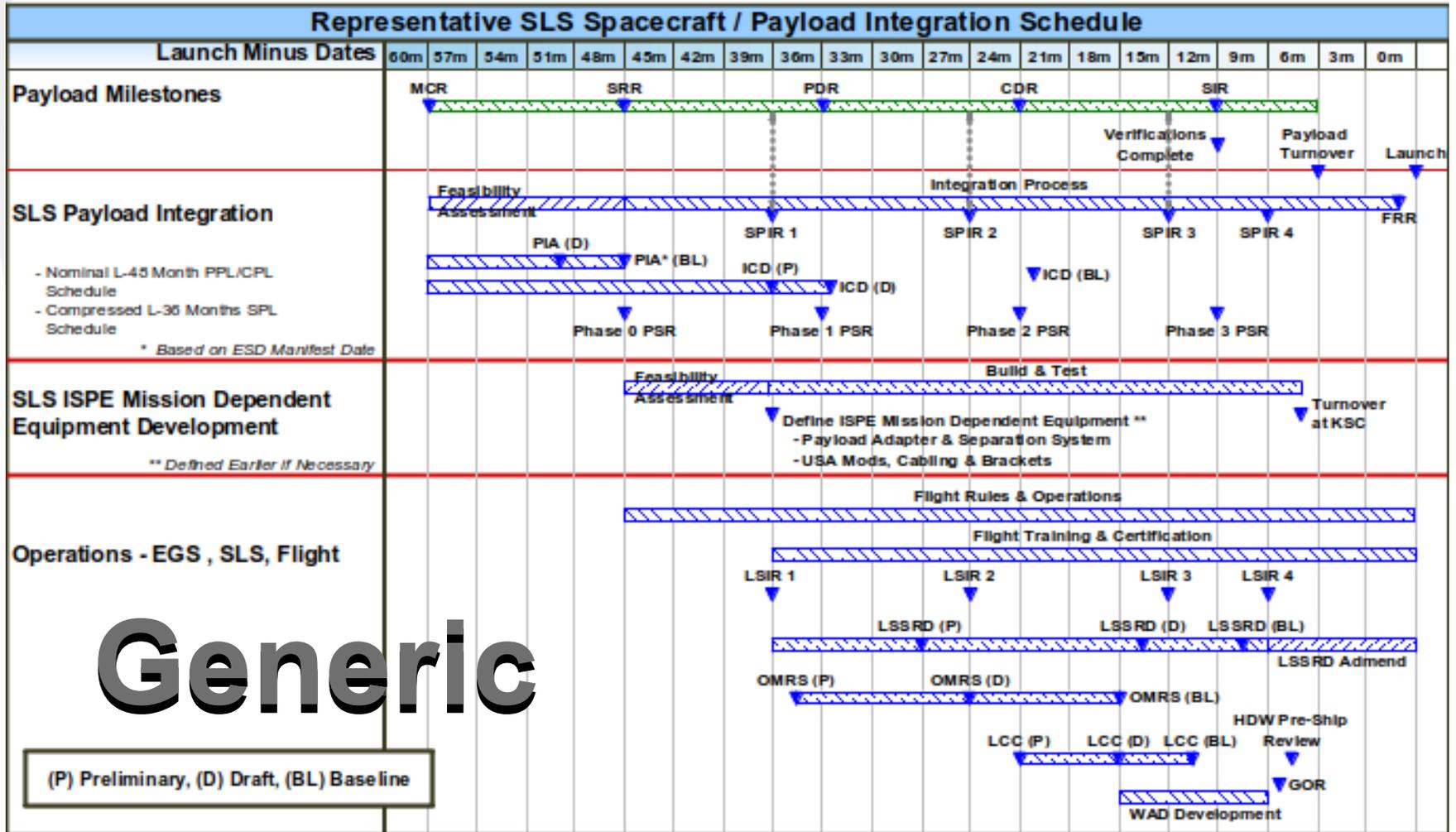
- LSSRD data feeds PRD
- Rollout NSS (purge requirements) / SS Purge requirements
- Payload access requirements (shorting plug install)
- OMRS provides work instructions via WADS
- LCC (requirement source) verify launch configuration supports mission objectives
- Contingency plans

EGS NOM

\*\* Automated Support Requirements System (ASRS)

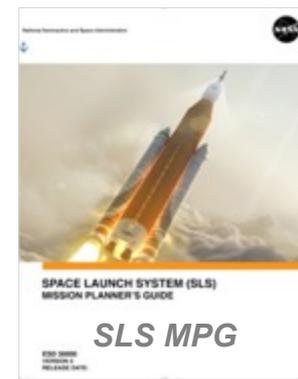
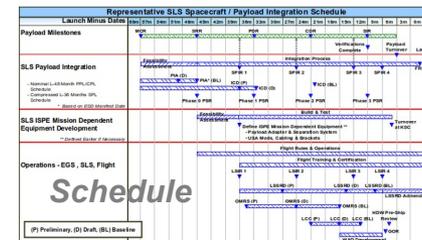
# Generic SLS Payload Integration Schedule

- To be customized based on IHAB Launch date on SLS; nominally 48 months to launch from formal manifesting



# SLS Payload Integration Preliminary Next Steps

- Jointly develop preliminary Gateway Logistics payload integration schedule
- Review [SLS Mission Planner's Guide](#) (ESD 30000) and fill-in ADMIT survey or provide a launch vehicle Interface Requirement Document (IRD)
- SLS SPIE to assess Gateway Logistics to launch vehicle interfaces and requirements based on ADMIT/IRD
- SLS SPIE to develop preliminary Gateway Logistics to SLS ICD based on ADMIT/IRD data



**BACK UP**

# SLS Payload Integration Documentation

## Definition

### **A SLS Mission Planner's Guide (MPG)**

- Provides developers/users with information to determine payload feasibility of flying on SLS in manner equivalent to established ELVs (i.e., D-IV, Atlas 5)
- Provides payload survey to define preliminary SLS accommodations or SLS uses payload provided Interface Requirements Document (IRD)
- Survey or IRD input is used to develop SLS to Payload unique ICD once manifested to fly on SLS

### **B**

#### **• Payload Specific Integration Agreement (PIA) or equivalent programmatic agreements**

- Bilateral agreement between SLS and CPL for negotiating and implementing management and technical integration requirements associated with NASA ESD manifest decision
- Defines SLS and CPL roles & responsibilities, specific interfaces, standard services, any non-standard services, deliverable exchanges, and the overall schedule for successful integration and launch
- Developed and coordinated by SLS/SPIE with revisions negotiated and agreed to by all parties as needed

# SLS Payload Integration Documentation

## Definition

### **C Payload Specific Interface Control Document (ICD)**

- Formally documents interface and requirements between SLS and CPL from initial ISPE/payload integration through ISPE/payload separation
- Agreed to design solution that controls and defines each side of interface (SLS or CPL) developed by SLS/SPIE with baseline approval at ESD JICB
- Defines each requirement success criteria used to close out verification
- Co-developed by SLS/SPIE, with EGS and Orion support as needed, and CPL with revisions negotiated and agreed to by all parties as needed

### **D Payload Specific Safety Requirement Document (SRD)**

- Defines safety requirements and establishes safety policy applicable to CPL from delivery at the launch site, through ascent until payload separation
- Defines CPL ground and flight processing hazard requirements
- Payload Safety Review Panel (PSRP) will assess flight and ground operations to determine whether any activities could result in hazards to SLS, EGS or Orion that manifest during prelaunch or flight operations